Numerical Modeling of Tsunami Inundation in Urban Area using Sub-Grid Scale Drag Force Model

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Numerical simulation of tsunami inundation using high-resolution topography (resolution is less than 1m) needs to consider the effect of structures on wave run-up. However, numerical simulation with medium resolution (resolution over 50m to 100m) is still important for practical use due to computational cost. This study developed Drag Force Model (DFM) and individual Drag Force Model (iDFM) as an urban roughness parameterization to obtain acceptable accuracy in medium resolution tsunami inundation model based on physical modeling. The model treats the effect of structures as grid-averaged drag force and projected area in x and y-direction in Cartesian coordinate and characteristic structure height are used as parameters representing the sub-grid scale structure. Furthermore, iDFM considers the number of structures and structure height in the area of interests individually. The edge detection technology for image processing tool is used to count the number of structures. Moreover, various mesh size 10cm to 40cm (25m to 100m in real scale) are used to check mesh size dependency. The validation DFM and iDFM is conducted using numerical simulation and physical modeling of tsunami inundation targeting available tsunami inundation experiments.

Keywords: tsunami, bottom roughness, drag force

